length. The cœcal tubes, which Dr. Sollas has shown to be probably organs of tactile impression, were wanting in the errantian forms, more or less abundant in those moving freely on a fixed pedicle, and in those fixed by the lower valve, abundant, and in *Crania* even branching. He described the external glands of *Terebratulina*, as well as the strand-like bundle of sperm cells. He insisted that the Heart of Hancock was not a pulsating organ, and was inclined to believe that the 'accessory hearts' were genital in their nature.

GLOVER M. ALLEN,
Secretary.

DISCUSSION AND CORRESPONDENCE.

CONNECTICUT RIVERS.

IN the issue of SCIENCE of November 29, 1901, Professor W. M. Davis reviews my paper on 'The River System of Connecticut' (*Journal of Geology*, IX., 1901, pp. 469–485) and expresses his doubt respecting the principal thesis of the paper; namely, that Connecticut rivers betray by their orientation a controlling influence of joint or fault planes. The subject of stream orientation is a large one and the explanation offered a somewhat new one for American rivers at least. The thesis is one not easily demonstrated as respects the larger area treated, and the review seems to me to be in the main an eminently fair one. From it I infer, however, that my paper may in some particulars be susceptible of misinterpretation, and, therefore, take this opportunity to correct certain impressions which appear in the review, so as, if possible, to prevent further misunderstanding.

If I have omitted to speak at length of the particular controls of stream orientation other than by joint and fault planes, it has not been because I would ascribe little importance to them, but because in a general paper dealing with a special kind of control it was obviously impossible to treat all at length. On page 474 it was stated:

"It is not to be expected that the actual course of a stream will now be coincident with or even absolutely parallel to any fault direction, for there have unquestionably been many local conditions which have produced larger or smaller migrations of the river channels. Their general direction has, however, it would seem, been maintained despite the minor accidents which have marked their life histories, and even under so revolutionary a change as complete reversal of drainage."

I should certainly agree with Professor Davis when he says that, "it is inherently improbable that the Pomperaug fault lines possess an extension all over the State in systems so rigid as are here postulated." And it was a matter of some surprise to me when the natural trough lines were found in so many instances to correspond to known fault directions of the Pomperaug Valley. Some explanation of this may, however, be found in the fact that the lines noted for the master streams of the State correspond in direction, not to the prevailing faults in the Pomperaug Valley, but rather to the exceptional ones. In the Shepaug Valley immediately adjacent to the Pomperaug, however, the only control observable is from the four directions of faulting which *prevail* in the Pomperaug Valley. It is my anticipation that when the theory is applied in detail to the broader area of the Connecticut Valley, and the directions of streams carefully compared with the directions of the actual *minor* as well as major faults of that Newark basin, a control will be recognized to have gone out from the planes of faulting. That the directions which were discovered in the Pomperaug Basin will be found to be the only ones I do not of course expect, and it is quite likely that in certain areas they may not appear at all. That an elaborate system of joints and faults, analogous to that of the Pomperaug Valley exists and is accountable for the zigzag outlines of the trap hills scattered over the Connecticut Valley seems to me, however, hardly to admit of doubt. That such a system ceases to exist beyond the border of the Newark is, in my view, inherently improbable.

I should be the last to wish to push the theory of control of streams by fault and joint planes beyond what the facts warrant. In the Pomperaug Valley itself the faults supposed to control the drainage were in the majority of instances discovered. In the near-lying area, *e. g.*, the Shepaug river basin, where the rivers adhere to the four prevailing fault directions of the Pomperaug Valley, this explanation seems

almost a necessity. As regards, however, the extension of the system throughout the State, where individual work in the field should be done in order to familiarize the worker with special and local conditions, I fully recognize the incompleteness of the evidence. It deserves to be emphasized, however, that the student of a carefully prepared map has always at hand the accumulated knowledge acquired by the corps of topographers whose painstaking labor it represents—labor which the modern school of physiographers has been quick to use as the basis of their conclusions. It is not assumed that along every trough line of the map lies the course of a fault. In my article it is stated (p. 478):

"The term 'trough lines' * * * may, for the present, be given no further signification than lines so favored by nature that the waters of the region have been induced to adopt them for their channels over longer or shorter distances. On a map of this scale the trough lines, if rectilinear, should be slightly curved, but inasmuch as the present river courses, because of the many accidents of their history, can only roughly approximate to the directions initially given them, it would be an over refinement to introduce a correction of this nature."

Evidence obtained from the examination of a map by this method can only be of value when cumulative. A single stream which persists in a given direction even for a long distance affords little support to the theory, when compared with that yielded by a number of smaller streams each approximating to a rectilinear course for a shorter distance, *provided the rectilinear courses are parallel.* A harder layer of rock, or a barrier of drift may conduct one stream or the other in its course, but it is inherently improbable that one of these causes or the other, or both combined, have controlled the parallel river series in an area of such geological structure as we find in the State of Connecticut. As was pointed out in the paper, it is worthy of note that so few of the master streams of the area follow the slope of the plain of erosion. As regards the larger area of the State the theory may, perhaps, as Professor Davis says, 'be regarded as standing in an interrogative rather than in a demonstrative attitude,' but it would be doing injustice to the facts to consider the trough lines as isolated lines while ignoring their arrangement in parallel series.

Wm. H. Hobbs.

PHYSIOLOGICAL EFFECT OF DIMINISHED AIR PRESSURE.

To the Editor of Science: The interesting communications of Messrs. Clayton and Ward upon the physiological effects of the diminished air pressure due to mountain climbing recall some records which I made in 1896 during an ascent of El Misti, Peru, similar to that described by Professor Ward. As the effect of the high altitude upon my condition was in part different from that experienced by him, it may be of interest to describe it. The journey from the observatory at Arequipa, elevation 8,050 feet, to the summit of El Misti, elevation 19,200 feet, was made on four occasions. The distance is about 25 miles. It is possible to ride on horseback or muleback to the very summit, following a caravan trail across the pampa to the base of the mountain, and ascending by a winding path constructed with great skill by Professor S. I. Bailey when the meteorological station was established. The journey from the observatory to a hut at an elevation of about 15,400 feet occupies one day, during which the rider is usually obliged to endure the scorching rays of the sun. The night is passed at the hut, and the final ascent to the summit made on the second morning. This occupies several hours, as the animal stops to rest every fifteen or twenty feet at this altitude. On two occasions I was obliged to walk a short distance to cross snow which had drifted across the path, and realized the extreme difficulty of breathing during the exertion required. The return from the summit to the observatory is easily made on the second day, but on two occasions I spent a second night at the hut.

The effect of the altitude upon me was chiefly to cause headache, sleeplessness and partial loss of appetite. On one occasion while at the summit I experienced a decided feeling of faintness for a short time. During the nights at the hut the temperature was about 32° Fahr., but it seemed impossible to keep the body warm, in